



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

h3

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/537,385	06/03/2005	Benjamin A. Haskell	30794.74USWO	4538

22462 7590 07/02/2007  
GATES & COOPER LLP  
HOWARD HUGHES CENTER  
6701 CENTER DRIVE WEST, SUITE 1050  
LOS ANGELES, CA 90045

EXAMINER
----------

LULIS, MICHAEL P

ART UNIT	PAPER NUMBER
----------	--------------

2824

MAIL DATE	DELIVERY MODE
-----------	---------------

07/02/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/537,385	HASKELL ET AL.	
	Examiner	Art Unit	
	Michael Lulis	2824	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 01/15/2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-17 and 19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17 and 19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 June 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>See Continuation Sheet</u> . | 6) <input checked="" type="checkbox"/> Other: <u>Search History</u> .                   |

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :12/20/2005, 04/20/2006, 07/28/2006, 10/11/2006, 12/14/2006, 01/15/2007.

## DETAILED ACTION

### *Information Disclosure Statement*

1. The information disclosure statements submitted on 12/20/2005, 04/20/2006, 07/28/2006, 10/11/2006, 12/14/2006, 01/15/2007 have been considered.
2. The IDS submitted \*\*\* lists \*\*\* references. It is noted that MPEP § 2004 suggests "It is desirable to avoid the submission of long lists of documents if it can be avoided. Eliminate clearly irrelevant and marginally pertinent cumulative information. If a long list is submitted, highlight those documents which have been specifically brought to applicant's attention and/or are known to be of most significance. See *Penn Yan Boats, Inc. v. Sea Lark Boats, Inc.*, 359 F. Supp. 948, 175 USPQ 260 (S.D. Fla. 1972), *aff'd*, 479 F.2d 1338, 178 USPQ 577 (5th Cir. 1973), *cert. denied*, 414 U.S. 874 (1974). But *cf. Molins PLC v. Textron Inc.*, 48 F.3d 1172, 33 USPQ2d 1823 (Fed. Cir. 1995)".

### *Claim Rejections - 35 USC § 102*

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

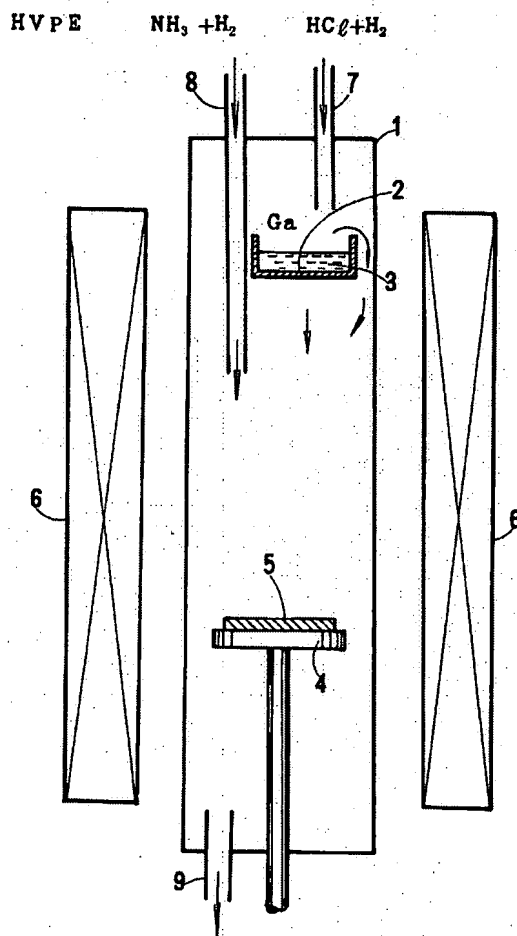
4. **Claims 1-5, 7, 8, 10, 16, 17, and 19 are rejected under 35 U.S.C. 102(e) as being anticipated by Motoki et al. (US 6468822 B2).**

5. **Regarding claim 1**, Motoki et al. disclose a method for forming a planar, non-polar, a-plane gallium nitride (GaN) film on a substrate, comprising: (a) loading a substrate (fig. 1, 5) into a reactor (fig. 1, 5), (b) heating the reactor to a growth temperature (column 31 line 60 to column 32 line 16); (c) reducing the reactor's pressure to a desired deposition pressure (column 31 line 60 to column 32 line 16), wherein the desired deposition pressure is below atmospheric pressure; (d) initiating a gaseous hydrogen chloride (HCl) flow (in fig. 1, 7) to a gallium (Ga) source (fig. 1, 3) to begin growth of the a-plane GaN film directly on the substrate, wherein the gaseous HCl reacts with the Ga to form gallium monochloride (GaCl) (column 3 line 54 to column 4 line 6); (e) transporting the GaCl to the substrate using a carrier gas that includes at least a fraction of hydrogen (H<sub>2</sub>), wherein the GaCl reacts with ammonia (NH<sub>3</sub>) at the substrate to form the GaN film (column 3 line 54 to column 4 line 6); and (f) after a desired growth time has elapsed (column 31 line 60 to column 32 line 16), interrupting the gaseous HCl flow, returning the reactor's pressure to atmospheric pressure, and reducing the reactor's temperature to room temperature.

6. **Regarding claim 2**, Motoki et al. disclose the method of claim 1 (see above), wherein the substrate is a sapphire substrate (column 27, lines 58-61 discloses that sapphire, while not desirable, is a possible starting substrate).

7. **Regarding claim 3**, Motoki et al. disclose the method of claim 1 (see above), wherein the substrate is coated with a thin film of GaN (column 28 lines 38-61), aluminum nitride (AlN), or aluminum gallium nitride (AlGa<sub>2</sub>N).

Fig. 1



Motoki et al. Figure 1

8. **Regarding claim 4**, Motoki et al. disclose the method of claim 2 (see above), wherein the substrate is coated with a nucleation layer (column 27 line 63 to column 28 line 18) deposited either at low temperatures or at the growth temperature.
9. **Regarding claim 5**, Motoki et al. disclose the method of claim 1 (see above), wherein the substrate is a free-standing GaN (column 29 lines 25-42), aluminum nitride (AlN), or aluminum gallium nitride (AlGaN) film.

10. **Regarding claim 7**, Motoki et al. disclose the method of claim 1 (see above), further comprising nitridating the substrate, at a temperature in excess of 900° C (column 31 line 60 to column 32 line 16).

11. **Regarding claim 8**, Motoki et al. disclose the method of claim 7 (see above), wherein the nitridating step comprises adding anhydrous ammonia (NH<sub>3</sub>) to a gas stream in the reactor to nitridate the substrate (column 3 line 54 to column 4 line 6).

12. **Regarding claim 10**, Motoki et al. disclose the method of claim 1 (see above), wherein the gaseous HCl reacts with the Ga at a temperature in excess of 600° C to form the GaCl (column 3 line 54 to column 4 line 6 and column 31 line 60 to column 32 line 16).

13. **Regarding claim 16**, Motoki et al. disclose a device (column 1 lines 9-16) manufactured using the method of claim 1 (see above).

14. **Regarding claim 17**, Motoki et al. disclose a device the device of claim 16 (see above), wherein the device is a laser diode, light-emitting diode (column 1 lines 9-16) or transistor.

15. **Regarding claim 19**, Motoki et al. disclose a device the device of claim 1 (see above), wherein the substrate is comprised of a patterned surface encouraging growth of the a-plane GaN film on selected areas of the surface (column 29 lines 25-42).

***Claim Rejections - 35 USC § 103***

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**17. Claims 6 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Motoki et al. (US 6468822 B2) in view of Kryliouk et al (US 6218280 B1).**

**18. Regarding claim 6,** Motoki et al. disclose a device the device of claim 1 (see above). Motoki et al. do not disclose expressly that the method further comprises evacuating the reactor and backfilling the reactor with purified nitrogen (N<sub>2</sub>) gas to reduce oxygen and water vapor levels therein before heating the reactor. Kryliouk et al. teach the step of evacuating a reactor and backfilling the reactor with purified nitrogen (N<sub>2</sub>) gas before heating the reactor (column 15 lines 27-40). Motoki et al. and Kryliouk et al. are analogous art because they are from the same field of endeavor, methods of forming GaN films. It would have been obvious at the time of invention to a person of ordinary skill in the art to add the step of evacuating the reactor and backfilling the reactor with purified nitrogen (N<sub>2</sub>) gas before heating the reactor to the method of Motoki et al. the motivation for doing so would have been to desorb any contaminants from the reactor walls (Kryliouk et al. column 15 lines 27-40).

**19. Regarding claim 9,** Motoki et al. disclose a device the device of claim 1 (see above), wherein the heating step (b) comprises heating the reactor to the growth temperature of approximately 1040° C (column 31 line 60 to column 32 line 16), with hydrogen (H<sub>2</sub>) flowing through all channels in the reactor (column 3 line 54 to column 4 line 6). Motoki et al. do not disclose expressly that the gas flowing through all channels in the reactor further comprises nitrogen (N<sub>2</sub>). Kryliouk et al. teach the use of nitrogen (N<sub>2</sub>) in a step of heating a substrate. Motoki et al. and Kryliouk et al. are analogous art



because they are from the same field of endeavor, methods of forming GaN films. It would have been obvious at the time of invention to a person of ordinary skill in the art to add nitrogen (N<sub>2</sub>) to the gas flowed in the step of heating the substrate in the method of Motoki et al. The motivation for doing so would have been at least that nitrogen (N<sub>2</sub>) is an inexpensive and well-known inert gas.

**20. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Motoki et al. (US 6468822 B2) in view of Bliss et al. (US 6969426).**

**21. Regarding claim 11,** Motoki et al. disclose a device the device of claim 1 (see above). Motoki et al. do not disclose expressly that the desired deposition pressure ranges from 5 to 100 Torr. Bliss et al. teaches optimizing HVPE deposition pressure (column 5 lines 15-20). Motoki et al. and Bliss et al. are analogous art because they are from the same field of endeavor, GaN film deposition. It would have been obvious at the time of invention to a person of ordinary skill in the art to optimize deposition pressure through routine experimentation. The recognized result of doing so would have been establishing the most suitable growth conditions (column 5 lines 15-20). See MPEP § 2144.05.

**22. Regarding claim 12,** Motoki et al. disclose a device the device of claim 1 (see above). Motoki et al. do not disclose expressly that the desired deposition pressure is approximately 76 Torr. Bliss et al. teaches optimizing HVPE deposition pressure (column 5 lines 15-20). Motoki et al. and Bliss et al. are analogous art because they are from the same field of endeavor, GaN film deposition. It would have been obvious at the time of invention to a person of ordinary skill in the art to optimize deposition

pressure through routine experimentation. The recognized result of doing so would have been establishing the most suitable growth conditions (column 5 lines 15-20). See MPEP § 2144.05.

**23. Claims 13, 14, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Motoki et al. (US 6468822 B2) in view of Molnar (US 6086673).**

**24. Regarding claim 13,** Motoki et al. disclose a device the device of claim 1 (see above). Motoki et al. do not disclose expressly that typical growth rates for the GaN film range from 1 to 50  $\mu\text{m}$ , per hour. Molnar discloses growth rates for a GaN film in the range from 1 to 50  $\mu\text{m}$ , per hour (column 10 lines 60-65). Motoki et al. and Molnar are analogous art because they are from the same field of endeavor, methods of forming GaN films. It would have been obvious at the time of invention to a person of ordinary skill in the art to grow the GaN films of Motoki et al. at a rate in the range from 1 to 50  $\mu\text{m}$ , per hour. The motivation for doing so would have been that the ranges are known in the art.

**25. Regarding claim 14,** Motoki et al. disclose a device the device of claim 1 (see above). Motoki et al. do not disclose expressly that the interrupting step (f) further comprises including anhydrous ammonia ( $\text{NH}_3$ ) in a gas stream to prevent decomposition of the GaN film during the reduction of the reactor's temperature. Molnar teaches the inclusion of anhydrous ammonia ( $\text{NH}_3$ ) in a gas stream during a reduction of a reactor's temperature (column 11 lines 20-28). Motoki et al. and Molnar are analogous art because they are from the same field of endeavor, methods of forming GaN films. It would have been obvious at the time of invention to a person of ordinary

skill in the art to include anhydrous ammonia ( $\text{NH}_3$ ) in a gas stream during the reduction of the reactor's temperature in the method of Motoki et al. The motivation would have been to suppress decomposition of the GaN layer (Molnar column 11 lines 20-28).

26. **Regarding claim 15**, Motoki et al. disclose a device the device of claim 1 (see above). Motoki et al. do not disclose expressly that the interrupting step (f) further comprises cooling the substrate at a reduced pressure between 5 and 760 Torr. Molnar suggests operating an HPVE reactor at subatmospheric pressure (column 4 lines 57-67). Motoki et al. and Molnar are analogous art because they are from the same field of endeavor, methods of forming GaN films. It would have been obvious at the time of invention to a person of ordinary skill in the art to cool the substrate at a reduced pressure between 5 and 760 Torr. The motivation for doing so would have been to reduce condensation on exhaust lines.

### ***Conclusion***

When responding to this office action, applicants are advised to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner in locating appropriate paragraphs.

A shortened statutory period for response to this action is set to expire three months and zero days from the date of this letter. Failure to respond within the period for response will cause this application to become abandoned (see MPEP 710.02(b)).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Lulis whose telephone number is (571) 272-


Art Unit: 2824

9015. The examiner can normally be reached on 8:30 AM to 5:00 PM Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on (571) 272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ML  
25 June 2007

  
ANH PHUNG  
PRIMARY EXAMINER